CHAPTER III

PROPOSAL

A Comparative Study on Cost-effectiveness between Resin and Glass-ionomer Used as Pit and Fissure Sealant in Mobile Dental Service for School Children at Municipality School, Buriram Province, Thailand

3.1   INTRODUCTION

Dental caries is one of the most highly prevalent oral diseases(WHO,1992). In Thailand, the fourth dental health survey conducted in 1994 found that eleven percent of children at the age of 6 years had dental caries in permanent molars. Only 14.7% of children age 6 years had no dental caries in both temporary and permanent teeth (Dental Health Division, Health Department, Ministry of Public Health, 1994).

The Oral Health Survey conducted in Buriram Province,Thailand in 1997 found that around 90.4 % children age 5-6 years in the urban area suffered from dental caries and 87.3 % in rural area and in children age 12 years47.7% children age 12 years in urban and 36.2% rural area were infected by the disease (Buriram Provincial Health Office,1997).

Buriram province has been doing pit and fissure sealant to prevent dental caries for school children for more than ten years. The most favorite material used is resin, provided by Ministry of Public Health. Resin has good characteristics such as high compressive strength, good retention rate and good caries prevention property if we can control moisture. It can not be used in partial erupted molar or in other situations where moisture cannot be controlled (Raddal, 1996), therefore it should be done in a clinical setting because we can prepare a perfect condition but in the field we have limitations regarding equipment and location which cannot be controlled as well as in the clinic.

At present, Buriram province faces the following problems in using resin as pit and fissure sealant as follows :

Lack of heavy equipment :

Buriram provincial health office survey of dental equipment conducted in 1999 found that there are 19 community hospitals and 20 main district health centers. However there were only 30 sets of mobile dental units which are inadequate for using resin in the field (Buriram Provincial Health office, 1999).

Limited budget for preventive program :

According to Thailand's universal coverage policy that allocates the budget per capitation and limits the budget for preventive program to only 20 % (Tungchearnsathian, 2001), so the budget must be managed well and in a good cost-effective manner.

3.2 RATIONALES

3.2.1 High dental caries prevalence :

The Buriram provincial oral health survey conducted in 1992 and in 1997 found that six years old children suffered from dental caries 79.7% and 93.97% respectively and the trend is increasing.

3.2.2 Limited budget for preventive program :

This requires good management to ensure cost-effectiveness.

This study is only going to protect occlusal caries in permanent first molars A Dental health promotion and preventive program is needed prevent dental caries in all surfaces of the teeth and not only first permanent molar, so the others strategies of dental health promotion and preventive program (Tooth brushing, Oral fluoride tablet intake, Useful food preparation, Oral cavity examination, Create good environment for dental health, Dental health education)have to take place at the time of the study.

3.3 RESEARCH QUESTION

When deciding between using resin or glass-ionomer, as pit and fissure sealant in mobile dental service for school children, which material is preferable in terms of cost-effectiveness?

3.4 HYPOTHESIS

The cost-effectiveness of glass-ionomer used as pit and fissure sealant in mobile dental service for school children is equal to that of resin.

3.5 OBJECTIVES

3.5.1 General objective :

To inform decision-making on cost-effectiveness between resin and glass-ionomer used as pit and fissure sealant in mobile dental service for school children

3.5.2 Specific objectives :

To define the effectiveness of resin and glass-ionomer used as pit and fissure sealant in mobile dental service for school children.

To define direct cost of resin and glass-ionomer used as pit and fissure sealant in mobile dental service for school children.

To define the cost-effectiveness in using resin and glass-ionomer as pit and fissure sealant in mobile dental service for school children

To provide a recommendations based on the result of this research study.

3.6 OPERATIONAL DEFINITIONS

3.6.1 Cost :

Cost in this research means cost of material and equipment based upon a calculation of only direct cost and tangible cost as follows.

3.6.1.1 Material cost

Means cost of resin and glass-ionomer used for sealing and calculated per 1 tooth

$$\text{Material cost} = \frac{\text{purchasing price per 1 pack of material}}{\text{Number of sealed teeth}}$$

3.6.1.2 Heavy equipment cost

Means cost of a mobile dental unit, mobile dental light and portable dental chair calculated per 1 tooth by using straight line method to calculate depreciation.

$$\text{Depreciation rate} = \frac{\text{Purchasing price - Cost of the remaining}}{\text{Life time}}$$

(Sukulaya, 1995)

Unit cost of heavy equipment

Unit cost = Cost per year /Number of sealed teeth per year

Unit cost = Depreciation per year / Number of sealed teeth per year

3.6.1.3 Hand instrument cost and other disposable accessory material :

Means cost of small instruments for sealant application consisting of explorer No.23, mouth mirror, cotton pliers, stainless steel tray, water cup, mendrel and rubber

cup, stone round bur, spoon excavator and other disposable accessory material consisted of saliva ejector, pumice, rubber cup, cotton roll, articulating paper, calculated per 1 tooth.

Depreciation rate = $\underline{\text{Purchasing price - Cost of the remaining}}$
$$\text{Life time}$$
(Sukulaya, 1995)

Unit cost of hand instrument

Unit cost = Cost per year /Number of sealed teeth per year

Unit cost = Depreciation per year / Number of sealed teeth per year

Unit cost of disposable accessory material

Unit cost = $\underline{\text{Purchasing price per 1 pack of material}}$
$$\text{Number of sealed teeth}$$

3.6.1.4 Time cost :

Means the time that the provider spends for doing a sealant procedure including time for equipment preparation and, sterilization calculated in monetary terms on the basis of the provider's salary and calculated per 1 tooth.

Time cost = $\underline{\text{Total salary of providers per 1 year}}$
$$\text{Number of sealed teeth per year}$$

Time cost = $\underline{\text{Total salary of providers per 1 year}}$
$$52\text{wks}\times5\text{days}\times6\text{hours}\times\text{No.of sealed teeth per hour}$$

Number of sealed teeth per hour = $\underline{\text{60 minutes}}$
$$\text{Time used for sealing 1 tooth (minutes)}$$

3.6.2 Pit and fissure sealing :

The procedure that makes the occlusal surface smooth by using sealing material.

3.6.3 Sealant :

Dental material that is used as sealing material.
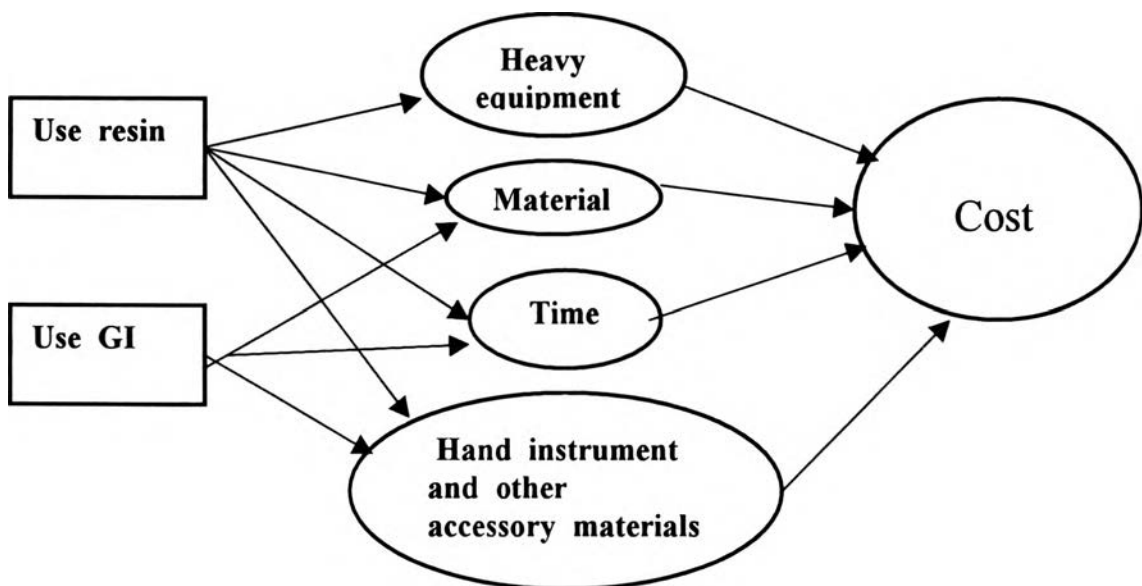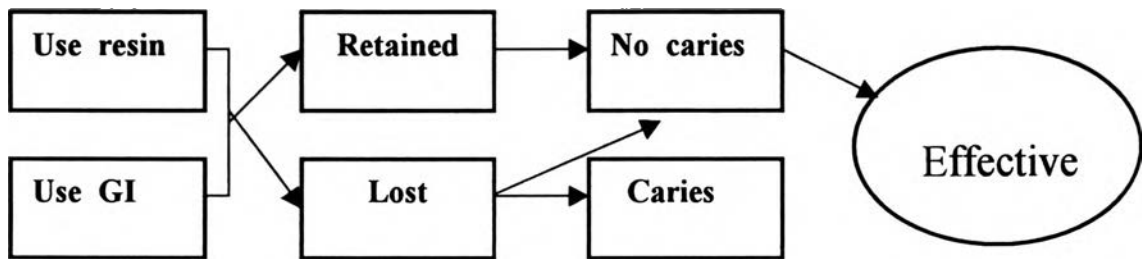
3.6.4 Resin :

Sealing material that adheres with enamel by mechanical bond.

3.6.5 Glass-ionomer :

Sealing material that adhere with enamel by chemical bond and that can release fluoride itself.

3.7 CONCEPTUAL FRAMEWORK

3.8 METHODOLOGY

3.8.1 Study design :

Quasi-experimental study to define the effectiveness of resin and glass-ionomer when using as pit and fissure sealant in mobile dental service for school children and compare the cost-effectiveness ratio between these two materials.

Using split mouth design and contra-lateral application

Independent variable :

sealing with resin and glass-ionomer

Dependent variable :

Dental caries rate at 2 years after sealing with resin and glass-ionomer.

Control variable :

Oral condition, resin and glass-ionomer in applied in the same mouth so the oral

condition is the same (split mouth design)

3.8.2 Target population :

School children in municipality school I, II, and III of Buriram province during

the school year 2003 with total population of 3,827.

3.8.3 Study population :

Children age 5-6 years in municipality school I, II and III of Buriram province

in the school year 2003 with a population of 630.

3.8.4 Sample size :

Calculate from this formula

(Noochprayoon and chumnijarakij, 1998)

$$n = \frac{(Z_\alpha + Z_\beta)^2 \, 2\,\overline{P}\,(1 - \overline{P})}{D^2}$$

n = sample

$\overline{p} = \frac{1}{2} (P_1 + P_2)$

P_1 = proportion of event in sample 1

P_2 = proportion of event in sample 2

$D = P_1 - P_2$

$\alpha = 0.5$, $Z_\alpha = 1.64$

$\beta = 0.1$, $Z_\beta = 1.28$

Effectiveness of resin   = 95.8 %

Effectiveness of glass-ionomer = 98.6 % (Gunlog, 1995)

$P_1 = 0.958$, $P_2 = 0.986$

$\overline{p}$ = $\frac{1}{2}$ (0.958 + 0.986) = 0.972

$D = P_2 - P_1 = 0.986 - 0.958 = 0.028$

$$n = \frac{(1.64 + 1.28)^2 \, 2 \, (0.972) \, (1 - 0.972)}{(0.028)^2}$$
n = 591.97 = 592

So if one kind of material is applied on 2 teeth in each of the children (split mouth design), 296 population will be used.

3.8.5 Sampling technique :

Purposive sampling with

Inclusion criteria_: Fully erupted permanent first molar both upper and lower

arch

Exclusion criteria : Children who have dental caries in permanent first molar teeth even for 1 tooth.

3.8.6   Methods :

Screening 5-6 years old children in municipality I, II and III schools

Using inclusion and exclusion criteria for sample size 296 population

The oral status will be categorized into 3 groups depending on the severity of dental caries by using the Decay, Missing and Filling Teeth Index (Mild : dmft < 3 teeth, Moderate : dmft 3-7 teeth and Severe : dmft > 7 teeth.) and will be recorded as the baseline data.

Select 148 children (one – half of the sample size) by simple random sampling and seal #16, #36 with resin material and seal #26, #46 with glass-ionomer.

The remaining 148 children seal #16, #36 with Glass-ionomer and seal #26, #46 with resin as shown in Figure 3.1 as shown in the following.

Figure 3.1:   The position of the permanent first molar teeth in the mouth.
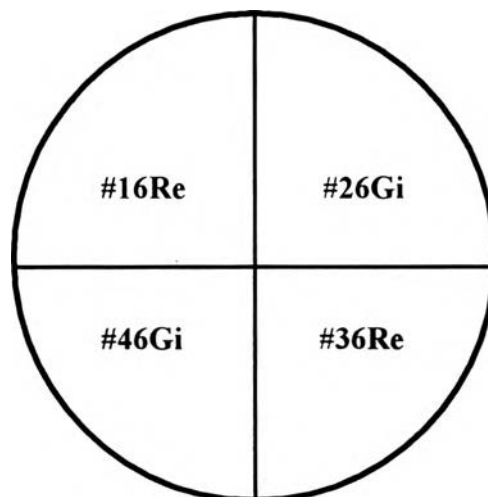
Collect data about material cost, heavy equipment cost, hand instrument and other accessory material cost and time cost during and after application (details are given in Appendix No. 1)

Collect data about caries prevention rate at 2 years after sealing.

The dmft index will be used to measure the oral status at 2 years after sealing.

The techniques for resin and glass-ionomer sealing are described in appendix No.2

3.8.7 Data collection

3.8.7.1 Data collection of 'cost'

a) Collect data of heavy equipment cost per one tooth after finishing the operation by calculating cost (Baht) per 1 tooth

$$\text{Equipment cost (per 1 tooth)} = \frac{\text{Depreciation per year}}{\text{Number of sealed teeth per year}}$$

$$= \frac{\text{Purchasing price /life time of equipment}}{52\text{wk} \times 5\text{days} \times 6\text{hours} \times (\text{No. of sealed teeth per hour})}$$

$$\text{Note : Number of sealed teeth per hour} = \frac{60 \text{ minutes}}{\text{Time used for sealing 1 tooth (minutes)}}$$

b) Collect data of hand instrument cost and other disposable accessory material cost per one tooth after finishing the operation by calculating cost (Baht) per 1 tooth.

$$\text{Hand instrument cost (per 1 tooth)} = \frac{\text{depreciation per year}}{\text{Number of sealed teeth per year}}$$

$$= \frac{\text{Purchasing price /life time of hand instrument}}{(52\text{wk}\times 5\text{days}\times 6\text{hours}\times(\text{No.of sealed teeth per hour})}$$

Note : Number of sealed teeth per hour $= \dfrac{60 \text{ minutes}}{\text{Time used for sealing 1 tooth (minutes)}}$

Other disposable accessory material cost (per 1 tooth)

$$= \frac{\text{Purchasing price per 1 pack of material}}{\text{Total number of sealed teeth per 1 pack of material}}$$

c) Collect data of material cost per one tooth after finishing the operation by calculating cost (Baht) per 1 tooth.

Material cost : calculate from resin and glass-ionomer used for 1 tooth

Material cost (per 1 tooth) $= \dfrac{\text{Purchasing price per 1 pack of material}}{\text{Total number of sealed teeth per 1 pack of material}}$

d) Collect data of time cost per one tooth after finish the operation by calculating cost (Baht) per 1 tooth

Time cost : Mean the time that provider spend for sealant application including time for equipment preparation and sterilization calculate in monetary term by comparing with provider's salary and calculate per 1 tooth

Time cost (per 1 tooth) $= \dfrac{\text{Time cost per year}}{\text{Number of sealed teeth per year}}$

Time cost (per 1 tooth) $= \dfrac{\text{Total salary of provider per year}}{\text{Number of sealed teeth per year}}$

3.8.7.2 Data collection of effectiveness

At the end of experiment (2 years) by using the dental caries prevention rate of resin and glass-ionomer will be used as the effectiveness.

Effectiveness can be measured in terms of the caries rate at 2 years after sealing and converted to the caries prevention rate, for example if we know that the caries rate is 5% we can convert this to a caries prevention rate of 95%

Criteria for dental caries measurement (WHO,1997)

     0   = No caries

     1   = Dental caries ; cavitated carious lesion

3.8.8   Data analysis :

Data will be analyzed, using the SPSS program to determine frequencies, percentages, means and standard deviations.

Chi-square will be used to test the difference of the effectiveness among 3 oral statuses children

Incremental cost-effectiveness ratio will be used to test the hypothesis

Compare the cost-effectiveness ratio between resin and glass-ionomer

3.9 ACTION PLAN

Activities	Fiscal year 2003-2005 (months)								
	1	2	3	4	...	28	29	30	31
Submit proposal	X								
Training operator and assistant		X							
Screening the children		X							
Sealant operation			X	X					
Data collection			X	X		X			
Data analysis							X		
Report writing						X	X	X	
Publication									X

3.10 BUDGETS

Estimated expenditure for program activities

Currency used : Thai Baht

Budget categories	Unit cost (Baht)	Multiplying factor	Total cost	% of total budget
1. Material				
-Resin sealant (Denton®)	3,500	6 packs	21,000	11.66%
-Glass-ionomer (Fuji III®)	3,550	6 packs	21,300	11.83%
2. Training operator and assistant				
- Special	180/day/ person	2 day/2 persons	720	0.39%

allowance for dentist and assistant	300/hr/person			
- Special wage for lecturer		12 hr./1 person	3,600	2%
	150/day/person			
- Food and drink		2day/3person	900	0.50%
3.Heavy equipments				
-Mobile dental unit	72,500/set	1 set	72,500	40.27%
-Portable dental chair	7,150/set	1 set	7,150	3.97%
-Mobile dental light	6,500/set	1 set	6,500	3.61%
4.Hand instruments and other disposable accessory material				
-Explorer No.23	350/piece	15 pieces	5,250	2.91%
-Mouth mirror	50/piece	15 pieces	750	0.41%
-Cotton pliers	250/piece	15 pieces	3,750	2.08%
-Stainless steel tray	250/piece	15 pieces	3,750	2.08%
-Water cup	80/piece	15 pieces	1,200	0.66%
-Cotton roll	34/pack	10 packs	340	0.18%
-Spoon excavator	350/piece	15 pieces	5,250	2.91%
-Mendrel and rubber cup	100/piece	15 pieces	1,500	0.83%
-Pumice powder	170/pack	2 packs	340	0.18%
-Articulating paper	180/pack	2 packs	360	0.19%
-Stone bur	120/piece	15 pieces	1,800	1.00%
-Disposable saliva ejector	100/pack	6 packs	600	0.33%

5.Screening the children				
-Fuel	100/day	2 days	200	0.11%
-Special allowance	180/day/person	2 days×3 persons	1,080	0.59%
6.Data collection				
-Special allowance	180/person/day	10 days×3 persons	5,400	3.00%
-Fuel	100/day		1,000	
-Food and drink	150/person/day	10 days	4,500	0.55%
		10 days×3 persons		2.49%
7.Data analysis				
-Special allowance	180/person/day	10 days×3 persons	5,400	3.00%
-paper			500	0.27%
	100/pack	5 packs		
8.Miscellaneous			3,360	1.86%
Total			180,000	100%

3.11 EXPECTED OUTCOME :

The cost-effectiveness of resin and glass-ionomer used as pit and fissure sealant in mobile dental service for school children based on research findings recommendations will be made to facilitate decision making.

3.12 ETHICAL CONSIDERATION :

During screening the children by using inclusion and exclusion criteria, the children with dental caries will be excluded in this study and will be sent to have dental caries treatment in municipality dental clinic free of charge.

Informed consent will be used for asking permission from children's parents. On completion of the research the children who have dental caries will be treated free of charge.

3.13 LIMITATION :

3.13.1 The intervention it takes 2 years, so some of the children might withdraw from the study.

3.13.2 Chewing style and eating habit of the children cannot be controlled, so if some of the children usually eat tough food, it might affect the result.

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